

## Section 2.1 Air Quality

### 12-month Issues

**12-AQ-1 Data Adequacy Deficiency** – Mitigation measures are not adequately discussed. See further explanation below under Appendix B (g) (8) (J) (ii) requirements [i.e., 12-AQ-10]

**Data Adequacy Response** – Please see Response 12-AQ-10 below.

**12-AQ-2 Data Adequacy Deficiency** – The District received the air permit application package on November 5<sup>th</sup>. The District will try to complete the application completeness assessment by November 19<sup>th</sup>, but has until December 5<sup>th</sup>, by rule, to finish their completeness assessment.

**Data Adequacy Response** – The District deemed the application complete on December 7<sup>th</sup>. A copy of the completeness letter is contained in Attachment 12-AQ-2.

**12-AQ-3 Data Adequacy Deficiency** – Description of control technologies proposed for the natural gas fired emergency generator engine. (note: the document is not consistent in identifying fuel type for the emergency generator, please confirm fuel type.)

**Data Adequacy Response** – The emergency generator will be a natural gas-fueled Caterpillar G3516 generator set. The unit will be turbocharged and aftercooled, and does not require additional emission controls to meet the District's BACT requirement.

**12-AQ-4 Data Adequacy Deficiency** – The emission rates of criteria pollutants from all secondary emission sources (i.e. ammonia deliveries, waste hauling, etc.).

**Data Adequacy Response** – Table 8.10-8 in the traffic and transportation section of the AFC (p. 6.11-35) shows the schedule for truck deliveries of hazardous materials associated with operation of the power plant. This table indicates that there will be approximately 2 to 3 deliveries made on a daily basis, 2 made on a weekly basis, 2 made on a monthly basis, and 5 made on a quarterly basis. This is consistent with the estimate of truck trips to the site per day (AFC Section 8.10.4.3). Based on the extremely low frequency of deliveries during the operations phase of the project, indirect impacts associated with worker traffic and material deliveries are insignificant from an air quality perspective.

**12-AQ-5 Data Adequacy Deficiency** – Estimated frequency of occurrence and duration of each potential startup mode (i.e. hot start, cold start, warm start, etc.), and estimated emission rate for each criteria pollutant for all types of startup events.

**Data Adequacy Response** – The requested information is provided on p. 8.1-26 and in Tables 8.1-20 and 8.1A-8 of the AFC. The information is repeated here for convenience.

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Maximum emission rates expected to occur during a startup or shutdown are shown in Table 8.1-20. PM<sub>10</sub> and SO<sub>2</sub> emissions have not been included in this table because emissions of these pollutants will be lower during a startup period than during baseload facility operation.

**TABLE 8.1-20**  
Facility Startup/Shutdown Emission Rates<sup>a</sup>

	NO <sub>x</sub>	CO	VOC
Startup/Shutdown, lb/hour	80 <sup>c</sup>	902	16
Startup/Shutdown, lb/start <sup>b</sup>	240	2,706	48

<sup>a</sup> Estimated based on vendor data and source test data. See Appendix 8.1A, Table 8.1A-7a and 7b.

<sup>b</sup> Maximum of three hours per start.

<sup>c</sup> Maximum value of 240 lb/hr used in dispersion modeling analysis of startup impacts.

As shown in Table 8.1A-8, cold starts are expected to last up to three hours; hot starts are expected to last up to one hour. Maximum daily emissions from the turbines are calculated based on one hot and one cold startup in any 24-hour period, for a maximum of four hours per day in startup and/or shutdown mode.

**12-AQ-6 Data Adequacy Deficiency** – Quarterly wind tables and hourly relative humidity data. If the original met data processed included present weather data and visible range data that should be provided to the CEC to complete the visible plume assessment for the cooling tower and HRSGs.

**Data Adequacy Response** – Quarterly wind tables are provided as Attachment 12-AQ-6. Hourly relative humidity data are not available from the NCDC data; however, dew point data are available. Five copies of the original NCDC data are being provided on diskette under separate cover.

**12-AQ-7 Data Adequacy Deficiency** – Some discussion of the stability class processing of the NCDC data should be provided for review.

**Data Adequacy Response** – PCRAMMET was used to prepare the meteorological data set. PCRAMMET used cloud cover and ceiling height data to calculate the initial stability categories. The calculated stability categories were then corrected for day/night time periods and wind speeds. Use of PCRAMMET and ceiling/sky cover data are the preferred regulatory method to determine stability. Wind speeds less than 0.5 m/s were set as calm. Wind speeds equal to or greater than 0.5 m/s were considered valid. Missing wind-speed, wind-direction, and temperature were linearly interpolated to replace the missing hours for time periods of three hours or less. Otherwise, missing data periods beyond three hours were coded as calm.

**12-AQ-8 Data Adequacy Deficiency** – Additionally, no identification of why certain years were selected (i.e. 1992 to 1995 and 1997) and others were not selected (i.e. 1996) was provided to complete the representative of conditions discussion.

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**Data Adequacy Response** – The Applicant requested from NCDC the most recent five years of concurrent meteorological data at the time the AFC was being prepared. NCDC supplied the 1992 through 1996 meteorological data. The five years of Lemoore surface meteorological data were processed with PCRAMMET. However, 1996 had more than 1000 hours of missing sky cover and wind speed data. Because of the missing data, the 1996 data set did not meet the 90 percent data recovery requirements contained in USEPA Modeling Guidance. Thus, in order to use five years of data, 1997 was used to replace the 1996 data. With the substitution of the 1997 data for the 1996 data, all five years of meteorological data exceeded the 90 percent availability requirement.

**12-AQ-9 Data Adequacy Deficiency** – The quantity of offsets listed did not include an assessment of the EPA PM<sub>10</sub> and PM<sub>10</sub> precursor offset Sanction that is currently in force for Major Stationary Source Projects within the San Joaquin Air Basin. This assessment should also address how the sanction will affect the SO<sub>2</sub> for PM<sub>10</sub> interpollutant offset ratio proposed

**Data Adequacy Response** – The Applicant provided supplemental information regarding emission offsets under the EPA sanctions in a letter to the District dated November 20. A copy of this letter was sent to the CEC; an additional copy is attached for convenience as Attachment 12-AQ-9.

The implementation of the EPA sanctions changes the SO<sub>x</sub>:PM<sub>10</sub> ratio from 2.7:1 to 3.2:1 as the 2:1 sanction ratio replaces the 1.5:1 distance ratio. The ratio calculation is revised as follows:

*...the overall offset quantity required is equal to the sum of the amount being emitted and the excess amount(s) required due to the sanction ratio plus the excess amount due to the interpollutant offset ratio. The computation of the resulting overall SO<sub>x</sub> for PM<sub>10</sub> offset ratio is as follows:*

$$\begin{aligned} \text{SOx req'd ton/year} &= \frac{\text{PM}_{10} \text{ ton/year} * 2}{1.2} + \text{PM}_{10} \text{ ton/year to be offset by SOx reductions} * \\ &= \text{PM}_{10} \text{ ton/year} * (2 + 1.2) \\ &= \text{PM}_{10} \text{ ton/year} * 3.2 \end{aligned}$$

**12-AQ-10 Data Adequacy Deficiency** – Location of offset sources. The confidential filing should include a tabular listing of all of the ERC sources to be used to offset the project emissions, their location of origin, and their method of emission reduction.

**Data Adequacy Response** – A listing of the ERC sources for the project was provided in the November 20 letter to the District, a copy of which is provided as Attachment 12-AQ-9. That listing is repeated here for convenience, along with available information regarding the locations and methods of the emissions reductions. As these offsets are all being obtained from the District ERC bank, all have been reviewed by the District to ensure that they are real, permanent and enforceable reductions.

**CENTRAL VALLEY ENERGY CENTER  
DATA ADEQUACY RESPONSES (01-AFC-22)**

TABLE 12-AQ-10  
ERC Sources

<b>Certificate Number</b>	<b>Location of Emission Reduction</b>	<b>Method of Emission Reduction</b>
<b>VOC</b>		
C-348	2907 S. Maple Avenue, Fresno	Shutdown of emissions units
S-1425	Heavy oil western stationary source; STR 14/31S/22E	Installation of cyclic well vent vapor control system
S-1665	South Coles Levee Gas Plant; STR SW03/31S/25E	Equipment modifications and shutdowns
S-1549	Heavy oil western, Moco T; STR 35/12N/24W	Installation of VOC collection/condensation system for fireflood operation
<b>NOx</b>		
S-1340	Heavy oil western, Taft oilfield; STR 02/11N/24W	Convert steam generators to gas firing and add SCR
S-1280	18405 highway 33, McKittrick; STR 30/28S/21E	Shutdown of gas turbine
N-196	757 E. 11 <sup>th</sup> St., Tracy	Retrofit of six boilers with Low-Nox burners and FGR
S-1554	Elk Hill; STR 35/30S/23E	Shutdown of steam generator
<b>SOx</b>		
N-270	16777 S. Howland Rd., Lathrop	Modification of acid plant
<b>PM10</b>		
N-208	18800 South Spreckels Rd	Shutdown of entire stationary source
C-347	2907 S. Maple Avenue, Fresno	Shutdown of emissions units
N-217	757 11 <sup>th</sup> St., Tracy	Shutdown of entire stationary source
N-255	757 11 <sup>th</sup> St., Tracy	Shutdown of entire stationary source
S-1577	12490 Garzoli, McFarland; STR NW01/26S/25E	Retrofit screen baskets and cyclones with more efficient cyclones
S-1578	12021 Avenue 328, Visalia; STR NE07/18S/25E	Replacement of screen baskets with cyclones
S-1666	526 Mettler Frontage Road East, Mettler	Shutdown of cotton gin

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**12-AQ-11 Data Adequacy Deficiency** – See above under Appendix B (g) (8) (J) (ii) requirements. [i.e., 12-AQ-10]

**Data Adequacy Response** – Please see Response 12-AQ-10.

**12-AQ-12 Data Adequacy Deficiency** – A schedule, with estimated dates, indicating when permits outside the authority of the commission will be obtained. This schedule should include anticipated delays, if any, due to the current EPA PM<sub>10</sub> and PM<sub>10</sub> precursor offset sanction.

**Data Adequacy Response** – An application for a Determination of Compliance and Authority to Construct was filed with the San Joaquin Valley Unified Air Pollution Control District on November 5, 2001. An application for a Prevention of Significant Deterioration permit was sent to EPA Region IX on November 5 as well. The Applicant expects the District application to be deemed complete by December 5, 2001. The District will issue a PDOC within 180 days (approximately June 15, 2002) and an FDOC within 240 days (approximately August 5, 2002) of accepting the application as complete. The Applicant expects to receive the PSD permit from EPA by approximately November 5, 2002. The Applicant does not anticipate any delays due to the EPA sanctions.

**6-month Issues**

**6-AQ-1 Data Adequacy Deficiency** – Offset compliance is not adequately discussed. See further explanation below under 12-month DA requirements for Appendix B (g) (8) (J) (ii) [i.e., 12-AQ-10]. Also see below under §2022(b)(1)(C) [i.e., 6-AQ-3].

**Data Adequacy Response** – A listing of the ERC sources for the project was provided in the November 20 letter to the District, a copy of which is provided as Attachment 12-AQ-9. That listing is repeated here for convenience, along with available information regarding the locations and methods of the emissions reductions. As these offsets are all being obtained from the District ERC bank, all have been reviewed by the District to ensure that they are real, permanent and enforceable reductions.

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DATA ADEQUACY RESPONSES (01-AFC-22)**

TABLE 6-AQ-1  
ERC Sources

<b>Certificate Number</b>	<b>Location of Emission Reduction</b>	<b>Method of Emission Reduction</b>
<b>VOC</b>		
C-348	2907 S. Maple Avenue, Fresno	Shutdown of emissions units
S-1425	Heavy oil western stationary source; STR 14/31S/22E	Installation of cyclic well vent vapor control system
S-1665	South Coles Levee Gas Plant; STR SW03/31S/25E	Equipment modifications and shutdowns
S-1549	Heavy oil western, Moco T; STR 35/12N/24W	Installation of VOC collection/condensation system for fireflood operation
<b>NOx</b>		
S-1340	Heavy oil western, Taft oilfield; STR 02/11N/24W	Convert steam generators to gas firing and add SCR
S-1280	18405 highway 33, McKittrick; STR 30/28S/21E	Shutdown of gas turbine
N-196	757 E. 11 <sup>th</sup> St., Tracy	Retrofit of six boilers with Low-Nox burners and FGR
S-1554	Elk Hill; STR 35/30S/23E	Shutdown of steam generator
<b>SOx</b>		
N-270	16777 S. Howland Rd., Lathrop	Modification of acid plant
PM <sub>10</sub>		
N-208	18800 South Spreckels Rd	Shutdown of entire stationary source
C-347	2907 S. Maple Avenue, Fresno	Shutdown of emissions units
N-217	757 11 <sup>th</sup> St., Tracy	Shutdown of entire stationary source
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S-1577	12490 Garzoli, McFarland; STR NW01/26S/25E	Retrofit screen baskets and cyclones with more efficient cyclones
S-1578	12021 Avenue 328, Visalia; STR NE07/18S/25E	Replacement of screen baskets with cyclones
S-1666	526 Mettler Frontage Road East, Mettler	Shutdown of cotton gin

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**6-AQ-2 Data Adequacy Deficiency** – Additionally, the Natural Gas Fired Emergency Engine has not been demonstrated to meet BACT.

**Data Adequacy Response** – The San Joaquin Valley Unified APCD's BACT guidelines do not include a determination for lean-burn natural gas fired emergency generators. However, the Applicant selected the lean-burn, natural gas fired emergency generator as a substitute for a Diesel generator, thereby minimizing emissions without requiring additional emissions controls. The Applicant believes that the District will accept the proposed emission limits as BACT for the emergency generator.

**6-AQ-3 Data Adequacy Deficiency** – Discussion of impending changes to San Joaquin Valley Air Pollution Control District fugitive dust control rules (Regulation XIII rules), the associated EPA PM<sub>10</sub> and PM<sub>10</sub> precursor offset sanction and the proposed timing of the project to comply with the anticipated rule changes and anticipated lifting of the offset sanctions. In particular, how does the Applicant propose to maintain a 6-month project schedule considering that it is more than likely that the District's rulemaking may not be complete and/or the EPA offset sanction may still be in force at the time of the Staff Assessment?

**Data Adequacy Response** – CVEC will be subject to requirements for control of fugitive dust emissions in accordance with the provisions of Regulation VIII (Fugitive PM<sub>10</sub> Prohibition), adopted by the District on November 15, 2001. The purpose of the rules in Reg. VIII is to reduce the amount of fine particulate matter entrained in the air, thereby reducing ambient PM<sub>10</sub> concentrations. These requirements will be applicable to the construction activities that will be part of the Project. Appendix 8.1D, Construction Impacts, describes the measures to be implemented to minimize fugitive dust from construction activities and to comply with the requirements of Reg. VIII. These measures are as follows:

- Use either water application or chemical dust suppressant application to control dust emissions from unpaved surface travel and unpaved parking areas;
- Use vacuum sweeping and/or water flushing of paved road surface to remove buildup of loose material to control dust emissions from travel on the paved access road (including adjacent public streets impacted by construction activities) and paved parking areas;
- Cover all trucks hauling soil, sand, and other loose materials, or require all trucks to maintain at least two feet of freeboard;
- Limit traffic speeds on unpaved surfaces to 25 mph;
- Install sandbags or other erosion control measures to prevent silt runoff to roadways;
- Re-plant vegetation in disturbed areas as quickly as possible;

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- As needed, use gravel pads along with wheel washers or wash tires of all trucks exiting construction site that carry track-out dirt from unpaved surfaces; and
- Mitigate fugitive dust emissions from wind erosion of areas disturbed from construction activities (including storage piles) by application of either water or chemical dust suppressant and/or use of wind breaks.

New paved and unpaved roads built for construction access will meet the applicable requirements of Rule 8061.

The Applicant has demonstrated to the SJVUAPCD that it owns sufficient ERCs to provide offsets at a 2:1 ratio as required under the EPA sanctions that are currently in effect. Therefore, the sanctions are not expected to have any effect on the District's permit processing schedule.

**6-AQ-4 Data Adequacy Deficiency** – A description of the project's planned initial commissioning phase, including the types and duration's of equipment tests, criteria pollutant emissions, including estimated stack parameters (i.e. velocity and temperature), for each test type, and monitoring techniques to be used during such tests.

**Data Adequacy Response** – A schedule and an estimate of the emissions expected during the gas turbine/HRSG commissioning period are included as Attachment 6-AQ-4. No stack parameters are available for the full speed, no load tests. Stack parameters during the other phases of the commissioning operations will vary as turbine conditions will be transient rather than steady state. The applicant used the minimum (70%) load parameters in evaluating impacts during turbine commissioning (see p. 8.1-39 of the AFC). These parameters are reproduced below.

Stack Velocity	14.96 m/s
Temperature	351.9 deg K

The continuous emissions monitors will be installed and operational during the commissioning activities, and will be calibrated regularly although they will not yet be certified. Hours of operation and fuel flow will also be monitored.

**6-AQ-5 Data Adequacy Deficiency** – A description of mitigation proposed for all affected criteria pollutants from construction activities (i.e. NO<sub>x</sub> and VOC as ozone precursors and SO<sub>2</sub> as a PM<sub>10</sub> precursor).

**Data Adequacy Response** – Mitigation measures proposed for pollutants emitted during construction activities were listed in the construction analysis, Appendix 8.1D, on page 8.1D-2. They are repeated here for convenience.

The following mitigation measures are proposed to control exhaust emissions from the Diesel heavy equipment used during construction of the Project:



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- Operational measures, such as limiting engine idling time and shutting down equipment when not in use;
- Regular preventive maintenance to prevent emission increases due to engine problems;
- Use of low sulfur and low aromatic fuel meeting California standards for motor vehicle Diesel fuel; and
- Use of low-emitting Diesel engines meeting federal emissions standards for construction equipment if available.

The following mitigation measures are proposed to control fugitive dust emissions during construction of the project:

- Use either water application or chemical dust suppressant application to control dust emissions from unpaved surface travel and unpaved parking areas;
- Use vacuum sweeping and/or water flushing of paved road surface to remove buildup of loose material to control dust emissions from travel on the paved access road (including adjacent public streets impacted by construction activities) and paved parking areas;
- Cover all trucks hauling soil, sand, and other loose materials, or require all trucks to maintain at least two feet of freeboard;
- Limit traffic speeds on unpaved surfaces to 25 mph;
- Install sandbags or other erosion control measures to prevent silt runoff to roadways;
- Re-plant vegetation in disturbed areas as quickly as possible;
- As needed, use gravel pads along with wheel washers or wash tires of all trucks exiting construction site that carry track-out dirt from unpaved surfaces; and
- Mitigate fugitive dust emissions from wind erosion of areas disturbed from construction activities (including storage piles) by application of either water or chemical dust suppressant and/or use of wind breaks.

**6-AQ-6 Data Adequacy Deficiency** – A description of mitigation proposed for the SO<sub>2</sub>, PM<sub>10</sub> precursor, operating emissions.

**Data Adequacy Response** – The ambient air quality analysis prepared for the project demonstrated that ambient SO<sub>2</sub> impacts from the proposed project are well below EPA and SJVUAPCD significance thresholds. In addition, SO<sub>2</sub> emissions from the project are well below the District offset thresholds. Therefore, the Applicant has concluded that the SO<sub>2</sub> impacts from the project are not significant and therefore no mitigation is required. If the CEC staff determine during the licensing process that the impacts are significant, the Applicant will discuss potential mitigation measures at that time.

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**Attachment 12-AQ-2  
SJVUAPCD Completeness Letter  
[Attach 12-AQ-2]**



San Joaquin Valley  
Air Pollution Control District

December 7, 2001

Robert L. Lamkin  
Vice President  
Central Valley Energy Center, LLC  
4160 Dublin Blvd.  
Dublin, CA 94568-3139

**Re: Notice of Complete Application**  
**Project Number: C-1011446 (01-AFC-22)**

Dear Mr. Lamkin:

The District has received your Authority to Construct application for the installation of a nominal 1060 MW combined cycle power generating facility, including an emergency natural gas-fired IC engine driving an electrical generator, emergency diesel-fired IC engine driving a fire pump, cooling tower, auxiliary boiler, and 3 natural gas-fired gas turbines at the N Section 25, Township 15S, Range 16E in San Joaquin, CA. Based on our preliminary review, the application appears to be complete. This means that your application contains sufficient information to proceed with our analysis. However, during processing of your application, the District may request additional information to clarify, correct, or otherwise supplement, the information on file.

Emissions from your project will exceed the public notification thresholds of District Rule 2201. Your project must therefore be public noticed for a 30-day period at the conclusion of our analysis, prior to the issuance of the Final Determination of Compliance. The estimated evaluation fee for this public notice process is \$13,875.00 (250 hours @ \$55.50/hr), less application filing fees paid, in accordance with District Rule 3010. No payment is due at this time; an invoice will be sent to you upon completion of the public notice process.

We will begin processing your application as soon as possible. In general, complete applications are processed on a first-come first-served basis.

David L. Crow  
Executive Director/Air Pollution Control Officer

Northern Region Office  
4230 Kiernan Avenue, Suite 130  
Modesto, CA 95356-9322  
(209) 557-6400 • FAX (209) 557-6475

Central Region Office  
1990 E. Gettysburg Avenue  
Fresno, CA 93726-0244  
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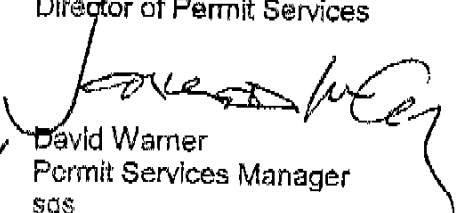
Southern Region Office  
2700 M Street, Suite 275  
Bakersfield, CA 93301-2370  
(661) 326-6900 • FAX (661) 326-6985

Mr. Lamkin  
December 7, 2001  
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**Please note that this letter is not a permit and does not authorize you to proceed with your project.** Final approval, if appropriate, will be in the form of "Authority to Construct" permits after application processing is complete. If you have any questions, please contact Mr. David Warner at (559) 230-5900.

Sincerely,

Seyed Sadredin  
Director of Permit Services

  
David Warner  
Permit Services Manager  
sqg

cc: Nancy Matthews, Sierra Research  
Will Walters, Aspen Environmental Group  
Steve Larson, California Energy Commission

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**Attachment 12-AQ-6  
Quarterly Wind Tables  
[Attach 12-AQ-6.xls]**

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

1992 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	246	151	151	285	78	6	24	3	0	0	0	944
NNE	100	65	56	66	11	2	6	1	0	0	0	307
NE	85	37	27	20	3	1	1	0	0	0	0	174
ENE	106	34	18	13	3	0	0	0	0	0	0	174
E	124	33	35	17	1	1	1	0	0	1	0	213
ESE	161	74	60	44	10	3	7	2	1	0	0	362
SE	184	96	95	88	28	7	14	4	1	1	0	518
SSE	167	72	68	71	26	7	27	4	0	1	0	443
S	126	56	37	32	16	0	5	2	0	1	0	275
SSW	109	38	22	15	6	1	1	0	0	0	0	192
SW	124	52	26	22	9	1	3	0	0	0	0	237
WSW	196	111	34	33	10	3	3	0	0	0	0	390
W	285	154	67	32	3	1	0	1	0	1	0	544
WNW	291	269	150	138	18	0	2	0	0	0	0	868
NW	273	365	294	438	100	13	48	11	2	3	0	1547
NNW	275	251	250	519	170	23	66	22	4	15	1	1596
TOTAL	2852	1858	1390	1833	492	69	208	50	8	23	1	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

First Quarter 1992 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	84	9	30	26	3	0	2	0	0	0	0	154
NNE	36	10	11	6	1	0	0	0	0	0	0	64
NE	45	8	10	2	1	0	0	0	0	0	0	66
ENE	46	10	6	6	1	0	0	0	0	0	0	69
E	59	9	27	6	0	1	0	0	0	1	0	103
ESE	86	23	46	27	4	2	3	1	1	0	0	193
SE	91	31	64	47	14	6	10	1	0	1	0	265
SSE	90	26	56	41	14	3	20	3	0	0	0	253
S	45	17	26	17	7	0	3	0	0	0	0	115
SSW	45	9	17	5	2	1	1	0	0	0	0	80
SW	34	10	13	7	2	1	0	0	0	0	0	67
WSW	64	21	13	14	4	1	2	0	0	0	0	119
W	98	13	9	5	1	0	0	0	0	1	0	127
WNW	73	16	17	11	0	0	0	0	0	0	0	117
NW	57	22	36	37	10	2	11	0	0	0	0	175
NNW	88	21	40	48	14	2	3	1	0	0	0	217
TOTAL	1041	255	421	305	78	19	55	6	1	3	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Second Quarter 1992 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	49	21	70	101	44	6	17	2	0	0	0	310
NNE	24	10	29	27	7	2	3	1	0	0	0	103
NE	7	7	11	10	1	1	1	0	0	0	0	38
ENE	15	5	5	3	1	0	0	0	0	0	0	29
E	7	1	2	6	1	0	1	0	0	0	0	18
ESE	7	3	5	6	2	0	2	1	0	0	0	26
SE	7	3	8	5	2	0	1	0	0	0	0	26
SSE	13	1	6	5	1	1	0	0	0	0	0	27
S	8	4	6	6	2	0	0	0	0	0	0	26
SSW	10	5	3	4	0	0	0	0	0	0	0	22
SW	12	4	8	8	2	0	1	0	0	0	0	35
WSW	33	6	14	11	1	1	1	0	0	0	0	67
W	41	9	42	21	2	1	0	0	0	0	0	116
WNW	58	36	59	66	11	0	2	0	0	0	0	232
NW	73	45	106	189	61	11	25	9	2	1	0	522
NNW	48	33	106	233	93	13	32	15	3	10	1	587
TOTAL	412	193	480	701	231	36	86	28	5	11	1	



LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Third Quarter 1992 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	40	61	33	112	14	0	1	0	0	0	0	261
NNE	7	18	7	22	3	0	1	0	0	0	0	58
NE	8	8	3	3	1	0	0	0	0	0	0	23
ENE	10	2	3	2	0	0	0	0	0	0	0	17
E	11	6	1	3	0	0	0	0	0	0	0	21
ESE	10	10	2	1	0	0	0	0	0	0	0	23
SE	17	9	4	0	0	0	0	0	0	0	0	30
SSE	7	6	0	0	1	0	0	0	0	0	0	14
S	19	12	2	2	0	0	0	0	0	0	0	35
SSW	8	13	0	1	0	0	0	0	0	0	0	22
SW	17	16	3	5	3	0	1	0	0	0	0	45
WSW	35	35	5	6	3	0	0	0	0	0	0	84
W	70	74	11	3	0	0	0	0	0	0	0	158
WNW	76	159	64	45	2	0	0	0	0	0	0	346
NW	64	236	127	155	13	0	2	0	0	0	0	597
NNW	72	128	75	162	30	2	5	0	0	0	0	474
TOTAL	471	793	340	522	70	2	10	0	0	0	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Fourth Quarter 1992 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	73	60	18	46	17	0	4	1	0	0	0	219
NNE	33	27	9	11	0	0	2	0	0	0	0	82
NE	25	14	3	5	0	0	0	0	0	0	0	47
ENE	35	17	4	2	1	0	0	0	0	0	0	59
E	47	17	5	2	0	0	0	0	0	0	0	71
ESE	58	38	7	10	4	1	2	0	0	0	0	120
SE	69	53	19	36	12	1	3	3	1	0	0	197
SSE	57	39	6	25	10	3	7	1	0	1	0	149
S	54	23	3	7	7	0	2	2	0	1	0	99
SSW	46	11	2	5	4	0	0	0	0	0	0	68
SW	61	22	2	2	2	0	1	0	0	0	0	90
WSW	64	49	2	2	2	1	0	0	0	0	0	120
W	76	58	5	3	0	0	0	1	0	0	0	143
WNW	84	58	10	16	5	0	0	0	0	0	0	173
NW	79	62	25	57	16	0	10	2	0	2	0	253
NNW	67	69	29	76	33	6	26	6	1	5	0	318
TOTAL	928	617	149	305	113	12	57	16	2	9	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

1993 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	221	199	104	284	124	17	42	14	0	3	0	1008
NNE	118	78	30	71	10	3	3	1	0	0	0	314
NE	84	56	14	16	4	0	0	0	0	0	0	174
ENE	90	34	11	16	3	0	0	0	0	0	0	154
E	127	72	10	28	3	1	1	0	0	0	0	242
ESE	155	97	21	48	14	0	6	0	0	0	1	342
SE	128	105	31	78	38	1	7	0	0	4	0	392
SSE	141	97	25	65	33	1	21	0	0	0	0	383
S	146	68	17	34	22	4	9	3	0	1	0	304
SSW	110	42	4	15	13	2	6	0	0	0	2	194
SW	158	57	4	28	7	1	12	0	0	1	0	268
WSW	218	133	17	17	9	1	18	2	1	3	0	419
W	275	197	31	19	3	0	4	0	0	1	0	530
WNW	298	291	75	89	13	0	4	1	0	0	0	771
NW	223	428	154	442	99	22	51	14	1	7	1	1442
NNW	273	397	191	558	193	33	120	36	5	15	2	1823
TOTAL	2765	2351	739	1808	588	86	304	71	7	35	6	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

First Quarter 1993 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	52	34	20	27	13	0	0	0	0	0	0	146
NNE	36	18	6	5	1	0	0	0	0	0	0	66
NE	15	12	1	4	0	0	0	0	0	0	0	32
ENE	38	14	6	4	3	0	0	0	0	0	0	65
E	56	40	5	14	2	1	0	0	0	0	0	118
ESE	70	44	11	31	11	0	6	0	0	0	1	174
SE	37	54	15	44	32	1	6	0	0	4	0	193
SSE	73	44	13	49	24	1	19	0	0	0	0	223
S	55	27	12	19	16	2	8	3	0	1	0	143
SSW	37	12	2	9	6	0	3	0	0	0	1	70
SW	31	12	1	13	2	1	3	0	0	0	0	63
WSW	58	23	8	7	3	0	2	0	0	0	0	101
W	58	32	5	1	0	0	0	0	0	0	0	96
WNW	71	50	17	14	5	0	1	0	0	0	0	158
NW	52	63	23	74	31	2	4	1	0	0	0	250
NNW	63	48	29	81	22	3	11	3	0	2	0	262
TOTAL	802	527	174	396	171	11	63	7	0	7	2	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Second Quarter 1993 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	27	54	30	128	88	15	35	14	0	3	0	394
NNE	11	23	7	24	2	3	2	1	0	0	0	73
NE	15	16	8	5	4	0	0	0	0	0	0	48
ENE	10	6	2	4	0	0	0	0	0	0	0	22
E	11	6	3	5	1	0	0	0	0	0	0	26
ESE	14	5	4	3	1	0	0	0	0	0	0	27
SE	12	11	2	11	1	0	0	0	0	0	0	37
SSE	6	7	7	4	2	0	0	0	0	0	0	26
S	16	8	3	4	2	2	1	0	0	0	0	36
SSW	11	5	0	5	5	0	1	0	0	0	1	28
SW	11	8	2	8	3	0	8	0	0	1	0	41
WSW	19	20	5	9	5	0	16	2	1	2	0	79
W	27	36	8	12	2	0	4	0	0	1	0	90
WNW	34	65	19	42	4	0	3	1	0	0	0	168
NW	30	83	40	145	51	16	41	10	1	1	1	419
NNW	47	100	47	195	119	26	88	30	4	12	2	670
TOTAL	301	453	187	604	290	62	199	58	6	20	4	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Third Quarter 1993 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	51	73	37	86	13	1	2	0	0	0	0	263
NNE	16	13	8	32	7	0	1	0	0	0	0	77
NE	8	8	4	6	0	0	0	0	0	0	0	26
ENE	6	3	1	1	0	0	0	0	0	0	0	11
E	5	4	0	2	0	0	0	0	0	0	0	11
ESE	10	4	0	2	0	0	0	0	0	0	0	16
SE	11	1	1	1	0	0	0	0	0	0	0	14
SSE	5	7	0	2	0	0	0	0	0	0	0	14
S	16	6	0	1	2	0	0	0	0	0	0	25
SSW	20	11	0	1	0	0	0	0	0	0	0	32
SW	32	13	1	5	1	0	0	0	0	0	0	52
WSW	53	55	1	1	0	0	0	0	0	0	0	110
W	85	76	11	5	0	0	0	0	0	0	0	177
WNW	76	124	26	24	2	0	0	0	0	0	0	252
NW	68	199	75	166	12	2	0	0	0	0	0	522
NNW	65	183	89	223	35	2	8	1	0	0	0	606
TOTAL	527	780	254	558	72	5	11	1	0	0	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Fourth Quarter 1993 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	91	38	17	43	10	1	5	0	0	0	0	205
NNE	55	24	9	10	0	0	0	0	0	0	0	98
NE	46	20	1	1	0	0	0	0	0	0	0	68
ENE	36	11	2	7	0	0	0	0	0	0	0	56
E	55	22	2	7	0	0	1	0	0	0	0	87
ESE	61	44	6	12	2	0	0	0	0	0	0	125
SE	68	39	13	22	5	0	1	0	0	0	0	148
SSE	57	39	5	10	7	0	2	0	0	0	0	120
S	59	27	2	10	2	0	0	0	0	0	0	100
SSW	42	14	2	0	2	2	2	0	0	0	0	64
SW	84	24	0	2	1	0	1	0	0	0	0	112
WSW	88	35	3	0	1	1	0	0	0	1	0	129
W	105	53	7	1	1	0	0	0	0	0	0	167
WNW	117	52	13	9	2	0	0	0	0	0	0	193
NW	73	83	16	57	5	2	6	3	0	6	0	251
NNW	98	66	26	59	17	2	13	2	1	1	0	285
TOTAL	1135	591	124	250	55	8	31	5	1	8	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

1994 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	278	331	161	394	165	20	69	6	2	0	0	1426
NNE	135	124	48	162	36	3	11	0	0	0	2	521
NE	72	65	26	35	2	0	1	0	0	0	0	201
ENE	121	48	15	16	4	0	0	0	0	0	0	204
E	130	70	17	15	5	0	1	0	0	0	0	238
ESE	170	89	17	30	10	0	1	0	0	0	0	317
SE	215	109	40	57	17	2	4	0	0	0	0	444
SSE	165	111	40	59	21	1	7	1	0	0	0	405
S	146	73	24	35	9	2	6	1	0	0	0	296
SSW	104	38	4	23	7	1	4	1	0	0	0	182
SW	128	51	7	8	6	1	4	2	0	0	0	207
WSW	206	90	11	19	2	0	4	2	0	1	0	335
W	280	136	25	22	3	1	3	0	0	2	0	472
WNW	188	186	47	42	6	1	1	0	0	1	0	472
NW	275	331	149	232	77	17	26	3	0	0	0	1110
NNW	292	465	239	552	209	51	108	12	1	1	0	1930
TOTAL	2905	2317	870	1701	579	100	250	28	3	5	2	



LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

First Quarter 1994 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	55	30	19	26	25	3	6	0	0	0	0	164
NNE	28	18	4	3	0	0	0	0	0	0	0	53
NE	21	11	2	3	0	0	0	0	0	0	0	37
ENE	48	7	3	0	0	0	0	0	0	0	0	58
E	65	25	5	6	3	0	0	0	0	0	0	104
ESE	71	34	5	16	6	0	1	0	0	0	0	133
SE	109	52	11	20	10	2	3	0	0	0	0	207
SSE	52	34	17	23	15	1	6	1	0	0	0	149
S	48	24	11	15	6	1	5	0	0	0	0	110
SSW	36	8	0	10	4	0	2	0	0	0	0	60
SW	38	11	2	1	3	1	4	1	0	0	0	61
WSW	79	34	3	4	1	0	2	1	0	0	0	124
W	94	35	3	6	0	0	1	0	0	1	0	140
WNW	50	55	11	19	3	0	0	0	0	1	0	139
NW	77	57	32	62	35	6	12	0	0	0	0	281
NNW	80	55	34	82	54	8	21	5	0	1	0	340
TOTAL	951	490	162	296	165	22	63	8	0	3	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Second Quarter 1994 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	29	65	41	206	115	14	53	4	1	0	0	528
NNE	13	30	13	92	27	2	9	0	0	0	1	187
NE	7	24	13	18	2	0	1	0	0	0	0	65
ENE	6	11	3	4	4	0	0	0	0	0	0	28
E	7	9	2	4	2	0	1	0	0	0	0	25
ESE	5	4	3	3	1	0	0	0	0	0	0	16
SE	14	9	8	10	3	0	0	0	0	0	0	44
SSE	5	11	7	8	1	0	0	0	0	0	0	32
S	11	12	8	5	0	1	0	1	0	0	0	38
SSW	10	9	1	3	0	1	2	0	0	0	0	26
SW	14	12	4	3	0	0	0	1	0	0	0	34
WSW	25	16	3	5	0	0	0	0	0	0	0	49
W	30	25	11	7	1	0	1	0	0	0	0	75
WNW	17	31	21	17	3	1	1	0	0	0	0	91
NW	29	48	38	89	38	10	13	3	0	0	0	268
NNW	44	78	71	266	113	34	66	5	1	0	0	678
TOTAL	266	394	247	740	310	63	147	14	2	0	1	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Third Quarter 1994 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	85	171	79	107	7	2	1	0	0	0	0	452
NNE	35	41	20	50	5	0	1	0	0	0	0	152
NE	14	14	9	8	0	0	0	0	0	0	0	45
ENE	14	15	6	7	0	0	0	0	0	0	0	42
E	11	10	5	2	0	0	0	0	0	0	0	28
ESE	11	14	1	1	0	0	0	0	0	0	0	27
SE	7	3	1	3	0	0	1	0	0	0	0	15
SSE	14	9	3	0	0	0	0	0	0	0	0	26
S	8	1	1	0	0	0	0	0	0	0	0	10
SSW	8	7	2	0	0	0	0	0	0	0	0	17
SW	34	15	0	0	0	0	0	0	0	0	0	49
WSW	55	19	2	2	0	0	0	0	0	0	0	78
W	65	38	7	4	0	0	0	0	0	0	0	114
WNW	68	78	8	2	0	0	0	0	0	0	0	156
NW	103	183	69	58	2	0	0	0	0	0	0	415
NNW	84	245	109	133	10	1	0	0	0	0	0	582
TOTAL	616	863	322	377	24	3	3	0	0	0	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Fourth Quarter 1994 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	109	65	22	55	18	1	9	2	1	0	0	282
NNE	59	35	11	17	4	1	1	0	0	0	1	129
NE	30	16	2	6	0	0	0	0	0	0	0	54
ENE	53	15	3	5	0	0	0	0	0	0	0	76
E	47	26	5	3	0	0	0	0	0	0	0	81
ESE	83	37	8	10	3	0	0	0	0	0	0	141
SE	85	45	20	24	4	0	0	0	0	0	0	178
SSE	94	57	13	28	5	0	1	0	0	0	0	198
S	79	36	4	15	3	0	1	0	0	0	0	138
SSW	50	14	1	10	3	0	0	1	0	0	0	79
SW	42	13	1	4	3	0	0	0	0	0	0	63
WSW	47	21	3	8	1	0	2	1	0	1	0	84
W	91	38	4	5	2	1	1	0	0	1	0	143
WNW	53	22	7	4	0	0	0	0	0	0	0	86
NW	66	43	10	23	2	1	1	0	0	0	0	146
NNW	84	87	25	71	32	8	21	2	0	0	0	330
TOTAL	1072	570	139	288	80	12	37	6	1	2	1	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

1995 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	325	329	112	387	112	17	29	11	1	4	0	1327
NNE	186	101	46	89	7	3	3	1	0	0	0	436
NE	94	57	11	22	2	1	1	0	0	0	0	188
ENE	133	47	7	22	1	0	0	0	0	0	0	210
E	140	64	11	12	4	0	1	0	0	0	0	232
ESE	167	68	23	51	10	1	6	1	0	0	0	327
SE	151	108	30	68	10	1	5	0	0	3	0	376
SSE	184	92	31	84	30	4	17	5	0	8	4	459
S	149	94	32	65	18	3	11	6	0	6	1	385
SSW	120	64	14	23	11	0	1	1	0	1	1	236
SW	136	57	10	14	8	1	2	0	0	0	0	228
WSW	219	87	12	14	5	2	0	0	0	0	0	339
W	355	143	19	21	2	1	2	2	0	0	0	545
WNW	332	273	45	33	6	1	1	0	0	0	0	691
NW	282	341	122	213	38	8	14	1	2	0	0	1021
NNW	377	383	160	549	168	17	66	22	3	14	1	1760
TOTAL	3350	2308	685	1667	432	60	159	50	6	36	7	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

First Quarter 1995 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	110	60	19	36	13	2	2	1	0	0	0	243
NNE	74	15	6	7	2	0	2	1	0	0	0	107
NE	29	9	1	1	0	0	1	0	0	0	0	41
ENE	39	6	1	3	0	0	0	0	0	0	0	49
E	56	11	4	4	3	0	0	0	0	0	0	78
ESE	85	27	17	34	7	1	5	1	0	0	0	177
SE	87	58	23	47	8	1	5	0	0	3	0	232
SSE	100	55	24	60	27	4	13	5	0	8	4	300
S	53	47	22	49	15	3	8	6	0	4	1	208
SSW	48	30	10	10	8	0	0	0	0	1	0	107
SW	34	15	3	7	3	1	1	0	0	0	0	64
WSW	32	10	2	2	2	0	0	0	0	0	0	48
W	70	12	2	3	0	1	1	0	0	0	0	89
WNW	78	15	0	1	1	0	1	0	0	0	0	96
NW	73	26	9	5	5	1	0	0	0	0	0	119
NNW	89	41	16	40	11	2	3	0	0	0	0	202
TOTAL	1057	437	159	309	105	16	42	14	0	16	5	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Second Quarter 1995 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	86	109	45	164	68	11	17	10	1	4	0	515
NNE	32	29	12	44	5	2	1	0	0	0	0	125
NE	11	16	6	10	1	1	0	0	0	0	0	45
ENE	16	14	5	8	1	0	0	0	0	0	0	44
E	29	20	3	2	0	0	0	0	0	0	0	54
ESE	16	9	1	2	0	0	0	0	0	0	0	28
SE	14	10	1	5	0	0	0	0	0	0	0	30
SSE	20	10	4	5	0	0	2	0	0	0	0	41
S	18	18	6	6	2	0	2	0	0	0	0	52
SSW	17	10	1	12	2	0	0	0	0	0	0	42
SW	12	11	3	4	3	0	1	0	0	0	0	34
WSW	34	18	3	7	2	1	0	0	0	0	0	65
W	60	35	8	9	2	0	1	2	0	0	0	117
WNW	62	42	7	14	4	1	0	0	0	0	0	130
NW	40	60	29	59	14	4	6	1	2	0	0	215
NNW	92	99	62	218	83	14	45	19	3	11	1	647
TOTAL	559	510	196	569	187	34	75	32	6	15	1	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Third Quarter 1995 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	71	95	30	144	21	1	5	0	0	0	0	367
NNE	16	21	18	19	0	0	0	0	0	0	0	74
NE	11	15	4	5	1	0	0	0	0	0	0	36
ENE	12	7	1	6	0	0	0	0	0	0	0	26
E	5	10	1	3	0	0	0	0	0	0	0	19
ESE	7	6	0	0	0	0	0	0	0	0	0	13
SE	7	8	0	1	0	0	0	0	0	0	0	16
SSE	4	1	0	1	0	0	0	0	0	0	0	6
S	19	10	0	0	0	0	0	0	0	0	0	29
SSW	21	7	0	1	0	0	0	0	0	0	0	29
SW	24	8	1	0	1	0	0	0	0	0	0	34
WSW	71	22	4	1	1	1	0	0	0	0	0	100
W	112	62	2	1	0	0	0	0	0	0	0	177
WNW	94	135	26	12	0	0	0	0	0	0	0	267
NW	98	178	61	93	8	0	1	0	0	0	0	439
NNW	109	172	53	199	36	1	5	1	0	0	0	576
TOTAL	681	757	201	486	68	3	11	1	0	0	0	



LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Fourth Quarter 1995 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	58	65	18	43	10	3	5	0	0	0	0	202
NNE	64	36	10	19	0	1	0	0	0	0	0	130
NE	43	17	0	6	0	0	0	0	0	0	0	66
ENE	66	20	0	5	0	0	0	0	0	0	0	91
E	50	23	3	3	1	0	1	0	0	0	0	81
ESE	59	26	5	15	3	0	1	0	0	0	0	109
SE	43	32	6	15	2	0	0	0	0	0	0	98
SSE	60	26	3	18	3	0	2	0	0	0	0	112
S	59	19	4	10	1	0	1	0	0	2	0	96
SSW	34	17	3	0	1	0	1	1	0	0	1	58
SW	66	23	3	3	1	0	0	0	0	0	0	96
WSW	82	37	3	4	0	0	0	0	0	0	0	126
W	113	34	7	8	0	0	0	0	0	0	0	162
WNW	98	81	12	6	1	0	0	0	0	0	0	198
NW	71	77	23	56	11	3	7	0	0	0	0	248
NNW	87	71	29	92	38	0	13	2	0	3	0	335
TOTAL	1053	604	129	303	72	7	31	3	0	5	1	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

1997 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	118	28	134	290	169	75	120	39	12	12	5	1002
NNE	68	25	80	152	66	8	5	1	0	0	1	406
NE	77	40	83	69	8	0	1	0	0	0	0	278
ENE	73	22	46	18	2	0	0	0	0	0	0	161
E	96	46	65	33	5	2	0	0	0	0	1	248
ESE	110	35	95	63	13	2	3	0	0	0	2	323
SE	90	39	107	98	23	4	5	1	0	0	3	370
SSE	73	37	69	76	20	6	10	4	0	0	0	295
S	62	31	65	36	8	4	4	2	0	1	0	213
SSW	73	23	37	29	2	0	1	0	0	0	0	165
SW	89	23	57	47	5	1	8	1	0	0	0	231
WSW	131	33	79	97	17	4	7	3	2	2	0	375
W	151	20	105	156	17	1	1	0	0	0	0	451
WNW	173	42	159	278	48	4	6	2	1	0	1	714
NW	170	50	190	616	274	87	154	30	9	7	7	1594
NNW	154	44	142	513	403	180	293	90	30	55	30	1934
TOTAL	1708	538	1513	2571	1080	378	618	173	54	77	50	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

First Quarter 1997 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	84	11	36	41	22	11	12	7	0	0	0	224
NNE	20	12	11	9	2	0	0	0	0	0	0	54
NE	36	12	10	5	0	0	0	0	0	0	0	63
ENE	36	3	4	3	0	0	0	0	0	0	0	46
E	40	16	13	7	0	0	0	0	0	0	0	76
ESE	67	12	28	15	2	0	2	0	0	0	1	127
SE	63	15	38	36	11	1	1	1	0	0	2	168
SSE	50	10	21	35	9	0	4	0	0	0	0	129
S	43	14	19	7	3	1	1	0	0	0	0	88
SSW	45	5	9	1	0	0	0	0	0	0	0	60
SW	60	1	5	6	1	1	4	0	0	0	0	78
WSW	58	10	9	16	4	0	1	0	0	1	0	99
W	72	5	17	22	3	0	0	0	0	0	0	119
WNW	92	14	30	33	5	0	1	0	0	0	0	175
NW	70	24	48	80	38	6	16	5	0	0	0	287
NNW	69	17	38	110	63	21	30	13	2	4	0	367
TOTAL	905	181	336	426	163	41	72	26	2	5	3	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Second Quarter 1997 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	15	2	24	106	94	43	77	27	9	10	4	411
NNE	12	1	7	34	25	6	5	1	0	0	1	92
NE	6	4	7	10	6	0	1	0	0	0	0	34
ENE	0	1	4	1	1	0	0	0	0	0	0	7
E	12	2	7	5	1	0	0	0	0	0	1	28
ESE	3	2	9	3	1	0	0	0	0	0	0	18
SE	3	1	3	8	0	0	0	0	0	0	0	15
SSE	1	2	3	3	0	1	1	0	0	0	0	11
S	2	1	5	3	0	0	0	0	0	0	0	11
SSW	7	3	2	4	1	0	0	0	0	0	0	17
SW	3	2	8	10	1	0	0	0	0	0	0	24
WSW	7	2	17	22	9	0	2	2	2	0	0	63
W	7	1	20	36	4	1	1	0	0	0	0	70
WNW	21	5	31	60	19	3	3	1	1	0	1	145
NW	21	1	32	127	87	48	91	20	8	6	7	448
NNW	25	6	28	141	178	106	178	53	17	34	24	790
TOTAL	145	36	207	573	427	208	359	104	37	50	38	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Third Quarter 1997 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	4	2	26	82	34	11	12	2	1	0	0	174
NNE	21	6	30	79	33	2	0	0	0	0	0	171
NE	16	11	38	38	2	0	0	0	0	0	0	105
ENE	11	4	16	5	0	0	0	0	0	0	0	36
E	5	8	14	4	0	0	0	0	0	0	0	31
ESE	4	2	7	11	3	0	0	0	0	0	0	27
SE	1	4	6	5	5	0	0	0	0	0	0	21
SSE	0	2	2	6	0	0	1	0	0	0	0	11
S	0	2	11	3	0	0	0	0	0	0	0	16
SSW	0	3	3	8	0	0	0	0	0	0	0	14
SW	7	10	14	14	0	0	2	0	0	0	0	47
WSW	15	4	24	28	4	3	4	0	0	0	0	82
W	17	3	26	53	8	0	0	0	0	0	0	107
WNW	31	8	51	131	17	1	1	1	0	0	0	241
NW	43	8	64	311	128	28	37	3	0	0	0	622
NNW	41	6	43	183	123	34	56	9	3	5	0	503
TOTAL	216	83	375	961	357	79	113	15	4	5	0	

LEMOORE NAVAL AIR STATION  
WIND FREQUENCY DISTRIBUTION  
WIND SPEED AT 10 METER HEIGHT (M/S)

Fourth Quarter 1997 (Hours)												
SECTOR	Wind Speed, m/s											TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	
N	15	13	48	61	19	10	19	3	2	2	1	193
NNE	15	6	32	30	6	0	0	0	0	0	0	89
NE	19	13	28	16	0	0	0	0	0	0	0	76
ENE	26	14	22	9	1	0	0	0	0	0	0	72
E	39	20	31	17	4	2	0	0	0	0	0	113
ESE	36	19	51	34	7	2	1	0	0	0	1	151
SE	23	19	60	49	7	3	4	0	0	0	1	166
SSE	22	23	43	32	11	5	4	4	0	0	0	144
S	17	14	30	23	5	3	3	2	0	1	0	98
SSW	21	12	23	16	1	0	1	0	0	0	0	74
SW	19	10	30	17	3	0	2	1	0	0	0	82
WSW	51	17	29	31	0	1	0	1	0	1	0	131
W	55	11	42	45	2	0	0	0	0	0	0	155
WNW	29	15	47	54	7	0	1	0	0	0	0	153
NW	36	17	46	98	21	5	10	2	1	1	0	237
NNW	19	15	33	79	39	19	29	15	8	12	6	274
TOTAL	442	238	595	611	133	50	74	28	11	17	9	

**CENTRAL VALLEY ENERGY CENTER  
DATA ADEQUACY RESPONSES (01-AFC-22)**

**Attachment 12-AQ-9  
November 20, 2001, Letter to SJVUAPCD  
[Attach 12-AQ-9.tif]**



**sierra  
research**

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November 20, 2001

Dave Warner  
Permit Services Manager  
San Joaquin Valley Unified  
Air Pollution Control District  
1990 East Gettysburg Avenue  
Fresno, CA 93726-0244

Re: Supplemental Information Regarding Emission Offsets and PM<sub>10</sub> Emissions  
Central Valley Energy Center

Dear Mr. Warner:

Based on recent clarifications to the District's implementation of offset requirements, we would like to make several corrections to the proposed offset package for Central Valley Energy Center (CVEC) that was submitted to the District on November 15. The purpose of this letter is to supplement the information provided in that submittal to address potential deficiencies. In addition, we would like to take this opportunity to reduce the proposed PM<sub>10</sub> emission rates for the turbines and duct burners at CVEC.

If you have any questions regarding the enclosed information, please do not hesitate to call.

Sincerely,

*Nancy Matthews*

Nancy Matthews

cc: Mike Argentine, Calpine  
Tom Lagerquist, Calpine  
Barbara McBride, Calpine  
Gregg Wheatland, Ellison & Schneider  
Keith Golden, CEC  
Gerardo Rios, USEPA



**Supplemental Information Regarding Offsets and PM<sub>10</sub> Emissions  
Central Valley Energy Center**

This submittal is intended to correct the calculation of the offset requirements and reduce the turbine/HRSG PM<sub>10</sub> emission rates for the Project. The modifications are as follows:

1. PM<sub>10</sub> Offset Ratio: Because of the EPA-imposed sanctions on the District for failure to demonstrate attainment of the federal PM<sub>10</sub> standard, the District is requiring the Applicant to demonstrate that offsets of all PM<sub>10</sub> precursors are available at a ratio of 2:1. District staff clarified that this ratio applies in lieu of, and not in addition to, any applicable distance ratio. Therefore, based on the Applicant's revised calculation of a 3.2:1 SOx:PM<sub>10</sub> ratio for the project location (including the 2.0:1 sanction ratio), CVEC is proposing to use SOx credits at an overall ratio of 3.2:1 to fulfill its PM<sub>10</sub> offset obligation, as long as the higher ratio remains in effect. The technical justification for the proposed SOx:PM<sub>10</sub> offset ratio was provided as part of the November 15, 2001, filing.
2. Offsets Required: Under District Rule 2201, offsets are required to be provided for emission increases in excess of the offset thresholds in Section 4.5.3. Therefore, the offsets required for the Project have been adjusted to reflect the thresholds as well as the applicable offset ratios. The table in Attachment 1 summarizes the ERCs that CVEC currently owns, and demonstrates that these ERCs are adequate to offset the emissions from the Project. While Calpine/CVEC owns these credits, some of the certificate titles have not yet been transferred. The table below shows certificate numbers for the ERCs, including the ones that are not yet registered in Calpine's name.
3. PM<sub>10</sub> Emissions from the Turbines/HRSGs: CVEC is proposing to reduce the PM<sub>10</sub> emission rates for the turbines and duct burners to 9.0 lb/hr without duct firing and 11.5 lb/hr with duct firing. Included as Attachment 2 are revised copies of Table 8.1A-1 and 8.1A-8 of the AFC, showing the calculated hourly, daily and annual PM<sub>10</sub> emissions for the Project based on the revised emission rates.

## ATTACHMENT 1

## SUMMARY OF TOTAL OFFSETS REQUIRED AND AVAILABLE

Source	1 <sup>st</sup> Quarter (lbs/quarter)	2 <sup>nd</sup> Quarter (lbs/quarter)	3 <sup>rd</sup> Quarter (lbs/quarter)	4 <sup>th</sup> Quarter (lbs/quarter)
<b>VOC</b>				
Project Emissions	39,351	39,351	39,351	39,351
Offset Threshold	5,000	5,000	5,000	5,000
Emissions Required to be Offset	34,351	34,351	34,351	34,351
Offsets Required (at 2:1)	68,702	68,702	68,702	68,702
<u>Offsets Available:</u>				
C-348-1 <sup>1</sup>	30,485	30,519	30,470	30,501
S-1425-1 <sup>1</sup>	24,274	24,274	24,274	24,274
S-1665-1 <sup>1</sup>	8,440	8,546	8,621	8,621
S-1549-1 <sup>2</sup>	4,952	5,873	6,795	6,794
Total Offsets Available <sup>1</sup>	68,151	69,212	70,160	70,190
ERCs from 3 <sup>rd</sup> Quarter Used in 1 <sup>st</sup> Quarter	551	0	(551)	0
Net Remaining Surplus (Shortfall)	0	511	908	1489
<b>NOx</b>				
Project Emissions	133,760	133,760	133,760	133,760
Offset Threshold	5,000	5,000	5,000	5,000
Emissions Required to be Offset	128,760	128,760	128,760	128,760
Offsets Required (at 2:1)	257,519	257,519	257,519	257,519
<u>Offsets Available:</u>				
S-1340-2 <sup>1</sup>	45,681	47,927	46,196	44,813
S-1280-2 <sup>1</sup>	20,238	17,410	19,037	19,604
N-196-2 <sup>1</sup>	0	0	22,593	0
S-1554-2 <sup>2</sup>	185,147	188,556	191,964	191,964
Total Offsets Available <sup>1</sup>	251,066	253,893	279,970	256,381
ERCs from 3 <sup>rd</sup> Quarter Used in Other Quarters	6,453	3,626	(11,217)	1,138
Net Remaining Surplus (Shortfall)	0	0	11,054	0
<b>SO<sub>2</sub></b>				
Project Emissions	10,908	10,908	10,908	10,908
Offset Threshold	13,688	13,688	13,688	13,688
Offsets Required	0	0	0	0
<u>Offsets Available:</u>				
N-270-5 <sup>2</sup>	395,000	344,100	298,948	298,948
SO <sub>2</sub> used for PM <sub>10</sub> at 3.2:1 <sup>3</sup>	(115,242)	(89,597)	(141,347)	(52,304)
Offset Surplus (Shortfall)	279,758	254,503	157,601	246,644

## SUMMARY OF TOTAL OFFSETS REQUIRED AND AVAILABLE

Source	1 <sup>st</sup> Quarter (lbs/quarter)	2 <sup>nd</sup> Quarter (lbs/quarter)	3 <sup>rd</sup> Quarter (lbs/quarter)	4 <sup>th</sup> Quarter (lbs/quarter)
<b>PM<sub>10</sub></b>				
Project Emissions	73,530	73,530	73,530	73,530
Offset Threshold	7,300	7,300	7,300	7,300
Emissions Required to be Offset	66,230	66,230	66,230	66,230
Offsets Required (at 2:1)	132,459	132,459	132,459	132,459
<u>Offsets Available:<sup>2,5</sup></u>				
N-208-4	715	8,177	6,581	715
C-347-4	50,845	67,976	8,408	42,056
N-217-4	302	308	4,900	391
N-255-4	0	0	52	0
S-1577-4	480	0	0	23,085
S-1578-4	421	0	176	46,954
S-1666-4	0	0	0	18,238
Subtotal	52,763	76,461	20,117	131,439
Fourth Quarter AER Used in Other Quarters (per Rule 2210.4.13.7).	7,670	0	24,000	(31,670)
Interpollutant Offsets (from SO <sub>2</sub> at 3.2:1) <sup>3</sup>	72,026	55,998	88,342	32,690
Total Offsets Available	132,459	132,459	132,459	132,459
Offset Surplus (Shortfall)	0	0	0	0

Note 1: Certificates owned by and registered to Calpine.

2. Certificate now owned by Calpine but still registered to Pastoria. Reflects excess over quantity required for Pastoria project.
3. SO<sub>2</sub> to PM<sub>10</sub> conversion shown reflects the difference between the sanction factor of 2.0:1 and the SO<sub>2</sub>:PM<sub>10</sub> conversion discount of 3.2:1. For example, in the first quarter, CVEC needs 72,026 lb/quarter of PM<sub>10</sub> offsets, including the sanction factor. As discussed in the interpollutant offset ratio analysis (submitted on 11/15/01), 3.2 lb of SO<sub>2</sub> are required to generate adequate offsets for 1 lb of PM<sub>10</sub> emissions. Therefore the quantity of SO<sub>2</sub> required to generate that quantity of PM<sub>10</sub> is 72,026\*3.2/2, or 115,242 lb/quarter.

**ATTACHMENT 2**

**REVISED CALCULATION OF PM<sub>10</sub> EMISSIONS FOR CVEC**

Table 8.1A-8: 8 hours of Aux Boiler Operation  
Detailed Calculations for Maximum Hourly, Daily and Annual Criteria Pollutant Emissions  
Central Valley Energy Center  
PM10 Emission Rates revised 11/14/01

	Base Load			Cold Start			Hot Start			NOx Emission Rates			SO2 Emission Rates			CO Emission Rates			VOC Emission Rates			PM10 Emission Rates		
	max. hour	hrs/day	hrs/yr	hrs/day	hrs/yr	hrs/day	hrs/day	hrs/day	hrs/yr	Base Load	Cold Start	Hot Start	Base Load	Cold Start	Hot Start	Base Load	Cold Start	Hot Start	Base Load	Cold Start	Hot Start	Base Load	Cold Start	Hot Start
Turbine 1, no DB	0	4	3244	3	156	1	260	1	260	17.83	80	80	1.38	838.0	902.0	76.06	838.0	902.0	3.48	16.0	16.0	3.48	16.0	16.0
Turbine 2, no DB	0	4	3244	3	156	1	260	1	260	17.83	80	80	1.38	838.0	902.0	76.06	838.0	902.0	3.48	16.0	16.0	3.48	16.0	16.0
Turbine 3, no DB	0	4	3244	3	156	1	260	1	260	17.83	80	80	1.38	838.0	902.0	76.06	838.0	902.0	3.48	16.0	16.0	3.48	16.0	16.0
Turbine 1, w/ DB&PA	1	16	5100	0	0	0	0	0	0	23.77	0	0	1.84	0	0	34.73	0	0	6.63	0.0	0.0	6.63	0.0	0.0
Turbine 2, w/ DB&PA	1	16	5100	0	0	0	0	0	0	23.77	0	0	1.84	0	0	34.73	0	0	6.63	0.0	0.0	6.63	0.0	0.0
Turbine 3, w/ DB&PA	1	16	5100	0	0	0	0	0	0	23.77	0	0	1.84	0	0	34.73	0	0	6.63	0.0	0.0	6.63	0.0	0.0
Aux Boiler	1	24	3000	0	0	0	0	0	0	1.80	0	0	0.11	0	0	6.20	0	0	0.70	0.0	0.0	0.70	0.0	0.0
Emergency generator	1	1	200	0	0	0	0	0	0	6.45	0	0	0.009	0	0	6.77	0	0	2.90	0.0	0.0	2.90	0.0	0.0
Fire pump engine	0.75	0.75	100	0	0	0	0	0	0	4.36	0	0	0.1281	0	0	2.63	0	0	0.54	0.0	0.0	0.54	0.0	0.0
Cooling tower	1	24	8760	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0

	NOx			SO2			CO			VOC			PM10		
	Max	Max	Total	Max	Max	Total	Max	Max	Total	Max	Max	Total	Max	Max	Total
Turbine 1, no DB	80.0	391.3	39.8	0.0	0.0	2.5	902.0	3,520.2	224.9	16.0	77.9	9.0	0.0	0.0	16.5
Turbine 2, no DB	0.0	391.3	39.8	0.0	0.0	2.5	0.0	3,520.2	224.9	0.0	77.9	9.0	0.0	0.0	16.5
Turbine 3, no DB	0.0	391.3	39.8	0.0	0.0	2.5	0.0	3,520.2	224.9	0.0	77.9	9.0	0.0	0.0	16.5
Turbine 1, w/ DB&PA	0.0	380.3	48.5	1.8	44.1	4.7	0.0	555.7	88.6	0.0	106.1	16.9	11.5	276.0	29.3
Turbine 2, w/ DB&PA	23.8	380.3	48.5	1.8	44.1	4.7	0.0	555.7	88.6	6.6	106.1	16.9	11.5	276.0	29.3
Turbine 3, w/ DB&PA	23.8	380.3	48.5	1.8	44.1	4.7	34.7	555.7	88.6	6.6	106.1	16.9	11.5	276.0	29.3
Turbines/Duct Burners	127.5	2315.0	264.8	5.5	132.3	21.6	971.5	12,227.8	940.4	29.3	552.0	77.7	34.5	828.0	137.4
Aux Boiler	1.8	43.2	2.7	0.11	2.7	0.17	6.2	148.8	9.3	0.7	16.8	1.1	3.30	79.2	5.0
Emergency generator	6.4	6.4	0.6	0.01	0.0	0.00	6.8	6.8	0.7	2.9	0.3	0.3	0.52	0.5	0.05
Fire pump engine	3.3	3.3	0.22	0.10	0.10	0.01	2.0	2.0	0.1	0.4	0.4	0.0	0.14	0.14	0.01
Cooling tower	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	1.1	25.9	4.7
Total	135.8	2367.9	268.4	135.1	135.1	21.8	984.4	12,385.3	950.5	32.9	572.1	79.0	39.4	933.7	147.1
			535038.0			43630.0			1899338.0			157403.0			294118.0

Assumptions:  
Each turbine has one cold start and one hot start on worst case day; startups lag by two hours, but to be conservative, no lag time is assumed.  
Boiler operates at full load 24 hrs/day on worst case day.  
Emergency generator and fire pump will not both be tested during the same one-hour period. Higher emission rate used for calculating hourly emissions.

**CENTRAL VALLEY ENERGY CENTER  
DATA ADEQUACY RESPONSES (01-AFC-22)**

**Attachment 6-AQ-4**

**CENTRAL VALLEY ENERGY CENTER  
DATA ADEQUACY RESPONSES (01-AFC-22)**

**Attachment 6-AQ-4**

The tests that will occur during the gas turbine/HRSG commissioning period are summarized below:

- Full Speed No Load Tests (FSNL) - These tests will occur over approximately a 3-day period per gas turbine/HRSG. The tests include a test of the gas turbine ignition system, a test to insure that the gas turbine is synchronized with its electric generator, and a test of the gas turbines over-speed system. During the tests, the heat input to the gas turbine will be up to approximately 20% of the maximum heat input rating.
- Part Load Tests - These tests will occur over approximately a 6-day period per gas turbine/HRSG. During the tests the gas turbine combustor will be tuned to minimize emissions and HRSG/steam line checks will be performed. During the tests, the heat input to the gas turbine will be up to approximately 60% of the maximum heat input rating.
- Full Load Tests (SCR Not Operational) - These tests will occur over approximately a 2-day period per gas turbine/HRSG. By the beginning of this test period, the gas turbine combustor will be completed tuned. Since the ammonia injection system will not be operated during this testing period, the SCR system will not be operational. The tests will include further checks on the HRSG and steam lines. During the tests, the heat input to the gas turbine will be up to approximately 100% of the maximum heat input rating.
- Full Load Tests (SCR Partial Operation) - These tests will occur over approximately a 1-day period per gas turbine/HRSG. During the tests the ammonia injection system will be tuned to minimize NOx. During the tests, the heat input to the gas turbine will be up to approximately 100% of the maximum heat input rating.
- Full Load Tests (SCR Fully Operational) - These tests will occur over approximately an 11-day period for gas turbine/HRSG number 1 and over approximately a 1 day period each for gas turbines/HRSGs numbers 2 and 3. By the beginning of this test period the SCR system will be completely tuned and achieving NOx control at design levels. During the tests, the heat input to the gas turbines will be up to approximately 100% of the maximum heat input rating.

Attached is an analysis of the emissions during the commissioning of the CVEC project.

**Gas Turbine/HRSG Commissioning Profile**

Operating Mode	Hours of Operation(1)	Fuel Use MMBtu/hr (2) (HHV)	Emission Factors (lbs/MMBtu)					Hourly Emissions (lbs/hr)					Total Emissions (lbs)				
			NOx(3)	CO(4)	VOC(5)	PM10(6)	SOx(7)	NOx	CO	VOC	PM10	SOx	NOx	CO	VOC	PM10	SOx
CTG/HRSG 1 - No Load	72	355	0.3520	0.5069	0.0479	0.0254	0.0007	125.00	180.00	17.00	9.00	0.25	9,000	12,960	1,224	648	18
CTG/HRSG 2 - No Load	72	355	0.3520	0.5069	0.0479	0.0254	0.0007	125.00	180.00	17.00	9.00	0.25	9,000	12,960	1,224	648	18
CTG/HRSG 3 - No Load	72	355	0.3520	0.5069	0.0479	0.0254	0.0007	125.00	180.00	17.00	9.00	0.25	9,000	12,960	1,224	648	18
CTG/HRSG 1 - 60% Load	144	1331	0.0962	0.2893	0.0120	0.0068	0.0007	128.00	385.00	16.00	9.00	0.95	18,432	55,440	2,304	1,296	136
CTG/HRSG 2 - 60% Load	144	1331	0.0962	0.2893	0.0120	0.0068	0.0007	128.00	385.00	16.00	9.00	0.95	18,432	55,440	2,304	1,296	136
CTG/HRSG 3 - 60% Load	144	1331	0.0962	0.2893	0.0120	0.0068	0.0007	128.00	385.00	16.00	9.00	0.95	18,432	55,440	2,304	1,296	136
CTG/HRSG 1 - Full Load - No SCR	48	1968.5	0.0960	0.0160	0.0018	0.0046	0.0007	189.00	46.00	3.48	9.00	1.40	9,072	2,208	167	432	67
CTG/HRSG 2 - Full Load - No SCR	48	1968.5	0.0960	0.0160	0.0018	0.0046	0.0007	189.00	46.00	3.48	9.00	1.40	9,072	2,208	167	432	67
CTG/HRSG 3 - Full Load - No SCR	48	1968.5	0.0960	0.0160	0.0018	0.0046	0.0007	189.00	46.00	3.48	9.00	1.40	9,072	2,208	167	432	67
CTG/HRSG 1 - Full Load - Partial SCR	24	1968.5	0.0525	0.0132	0.0018	0.0046	0.0007	103.40	26.10	3.48	9.00	1.40	2,482	626	84	216	34
CTG/HRSG 2 - Full Load - Partial SCR	24	1968.5	0.0525	0.0132	0.0018	0.0046	0.0007	103.40	26.10	3.48	9.00	1.40	2,482	626	84	216	34
CTG/HRSG 3 - Full Load - Partial SCR	24	1968.5	0.0525	0.0132	0.0018	0.0046	0.0007	103.40	26.10	3.48	9.00	1.40	2,482	626	84	216	34
CTG/HRSG 1 - Full Load - Full SCR	264	1968.5	0.0091	0.0132	0.0018	0.0046	0.0007	17.83	26.10	3.48	9.00	1.40	4,707	6,890	920	2,376	369
CTG/HRSG 2 - Full Load - Full SCR	24	1968.5	0.0091	0.0132	0.0018	0.0046	0.0007	17.83	26.10	3.48	9.00	1.40	428	626	84	216	34
CTG/HRSG 3 - Full Load - Full SCR	24	1968.5	0.0091	0.0132	0.0018	0.0046	0.0007	17.83	26.10	3.48	9.00	1.40	428	626	84	216	34
CTG/HRSG 1 - Hot Starts	6							80.00	838.00	16.00	11.50	1.84	480	5,028	96	69	11
CTG/HRSG 2 - Hot Starts	6							80.00	838.00	16.00	11.50	1.84	480	5,028	96	69	11
CTG/HRSG 3 - Hot Starts	6							80.00	838.00	16.00	11.50	1.84	480	5,028	96	69	11
<b>Total =</b>	<b>1194</b>												<b>123,960</b>	<b>236,930</b>	<b>12,712</b>	<b>10,790</b>	<b>1,234</b>

**Notes:**

(1) Hours of Operation - based on information supplied by Calpine.

(2) Fuel Use

- No Load test: Based on information supplied by Calpine.
- 60% Load test: Based on 60% load fuel use for a 501F machine during a 36 deg. F day.
- Full Load tests: Based on baseload fuel use for a 501F machine during a 36 deg. F day.

(3) NOx Emission Factors

- No Load test: Based on information supplied for a GE 7FA machine.
- 60% Load test: Based on Calpine-supplied S-W performance run on a 501F machine with a NOx emission level of 25 ppm @ 15% O2.
- Full Load No SCR test: Based on Calpine supplied S-W performance run with NOx levels of 25 ppm @ 15% O2 for 501F machine.
- Full Load Partial SCR test: Based on information supplied by Calpine with NOx emission levels at the midway point between 25 ppm and 2.5 ppm @ 15% O2.
- Full Load Full SCR test: Based on unit meeting the project design NOx emission level of 2.5 ppm @ 15% O2.
- Hot Startups: Based on maximum NOx emission level expected during hot startups.

(4) CO Emission Factors

- No Load test: Based on information supplied by Calpine for a GE 7FA machine with CO emissions of 180 lbs/hr.
- 60% Load test: Based on the commissioning CO emission level used for a GE 7FA machine at the Crockett plant with a CO emission level of 385 lbs/hr.
- Full Load No SCR test: Based on Calpine supplied S-W performance runs for a 501F machine with CO levels of 10 ppmvd @ actual % O2.
- Full Load Partial SCR test: Based on unit meeting the project design level of 6 ppm @ 15% O2 with oxidation catalyst installed and operating.
- Full Load Full SCR test: Based on unit meeting the project design level of 6 ppm @ 15% O2 with oxidation catalyst installed and operating.
- Hot Startups: Based on maximum CO emission level expected during hot startups.

(5) VOC Emission Factors

- No Load test: Based on information supplied by Calpine for a GE 7FA machine with VOC emissions of 17 lbs/hr.
- 60% Load test: Based on the expected startup VOC emission level of 16 lbs/hr.
- Full Load No SCR test: Based on Calpine supplied S-W performance runs for a 501F machine with VOC levels of 1.4 ppmvw @ actual % O2.
- Full Load Partial SCR test: Based on Calpine supplied S-W performance runs for a 501F machine with VOC levels of 1.4 ppmvw @ actual % O2.
- Full Load Full SCR test: Based on Calpine supplied S-W performance runs for a 501F machine with VOC levels of 1.4 ppmvw @ actual % O2.
- Hot Startups: Based on maximum VOC emission level of 16 lbs/hr expected during hot startups.

(6) PM10 Emission Factors

- For all test except hot startups, based on project design PM10 level of 9 lbs/hr.
- For hot startups, based on maximum expected PM10 level during full load operation with duct burner operation (i.e., 11.5 lbs/hr).

(7) SOx Emission Factors

- For all test except hot startups, based on project design maximum natural gas sulfur content of 0.25 gr/100 scf.
- For hot startups, based on maximum expected SOx emission level during full load operation with duct burner operation (i.e., 1.84 lbs/hr).